Bayesian Constrained Optimization of IEEE 802.11 VANET for Safety Applications

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***Abstract*—IEEE 801.11p/bd based Vehicular Ad Hoc Networks (VANETs) have been introduced to improve road safety that involves message broadcast with low transmission latency and high reliability. Different safety-critical applications of VANETs have different quality of service (QoS) requirements under dynamic vehicular environments. A set of dynamically adaptive parameters for the communication networks is essential to obtain the best channel efficacy constrained on that the QoS requirements are satisfied. However, the complexity and high computation consumption of simulation models for safety applications make direct parameter optimization inaccessible. This paper proposes a real-time optimization scheme for VANET safety applications based on a Bayesian constrained optimization algorithm. The scheme consists of a Bayesian Optimization algorithm and an analytical model for IEEE 802.11 VANET channel access. The Bayesian Optimization generates surrogate functions with lower computational costs based on the sampling points obtained from the analytical model or measurement observations, incorporates QoS requirements as the optimization constraints, and iterates to find the optimal parameters for the best channel usage. Experiments results on Python demonstrate that compared with other non-gradient optimization algorithms, the Bayesian Optimization can converge to the optimal parameters solutions for IEEE 802.11 driven VANETs efficiently and accurately.**

Keywords— Optimization, Bayesian Optimization, Ad hoc networks, Quality of Service, Safety

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